

Assessing the Risk of Bank Failure in Cameroon: A Z-Scoring Approach

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Abstract

This study attempts to answer the question: the current financial stability of the banking system in Cameroon today, means there no risk of bank failure? Based on annual accounting data banks in Cameroon are estimated using Z-Scoring approach, indicators of bank failure and the associated probabilities between 1980 and 2006. Our results show a trend of increasing bank failures. It also appears that the risk of bank failure is due to both an insufficient risk coverage by own funds and exposure of banks to the risk of their activities. However, the risk to banks' activities was the major factor in the risk of bank failure in Cameroon. We note also that if the probability of bank failure due to insufficient capital is zero between 1998 and 2006, period of high stability of the banking system, it is not that due to the exposure of banks the risk of their activities. This shows that despite the financial stability of the banking system today, the results nevertheless indicate a probability of default non-zero.

Keywords: Risk, Failure, Bank.

JEL Classification Codes: C52, G21, G33

1. Introduction

The financial environment in recent decades, marked by two major developments has increased the risk of bank failure defined simply as the possibility of occurrence of an event which prevents the bank to deal with any time commitments. On one hand, liberalization and the corresponding increase competition in the banking sector, because of financial globalization. On the other hand, changing the traditional framework of analysis based on the Arrow-Debreu model in which markets are perfect in the sense of Modigliani-Miller (1958), in favour of the paradigm of asymmetric information. This context clearly shows new risks, including market risk¹. In this new context, in fact, banks are viewed as firms in the same way as a commercial or industrial (Freixas and Rochet, 1997).

To cope with increased competition, banks are induced to leave their traditional activities to engage in the conquest of market share in the high risks, unknown and difficult to evaluate. This rise in risk is very detrimental to the profitability and margins, bank have spared no region of the globe² as is

¹ They are: the exchange risk on transactions of borrowing and lending in foreign currency risk due to exchange rate fluctuations; risk of financial speculation in securities which depends for its strategy of investment institutions Financial and degree of turbulence or calm conditions in the financial markets

² For more details on this aspect, see among others L. Tchamanbé Djine (2001), the BIS report (1986).

demonstrated by the outbreak of crises and bank failures of 1980, 1990, and 2000 and most recently, the subprime crisis began in 2007 in the United States.

To counter the rising risks, most countries have initiated a broad program of reforms in the banking, monetary and institutional sectors. Reforms in the institutional framework in particular, have generally led to the creation of a banking supervisory agency³, which is now the enactment of a regulatory framework and enhanced surveillance system by imposing stricter prudential rules to banks, including capital requirements.

On this last point, Heggstad (1978), Koehn and Santomero (1980) show that the new prudential regulations have a limited effect if they are accompanied by development operations off-balance. Indeed, these authors demonstrate that the effect of strengthening the capital on the fragile banking sector may be contrary to that expected if it led to portfolio reallocations in favour of riskier assets. In this sense, Furlong, 1988 shows that despite a significant increase of requirements of capital, the risk of bankruptcy of U.S. banks would have increased significantly since the early 1980s. In the same considerations, Goyeau and Tarazi (1992) emphasize that the finding made in the USA is also for Europe, with a magnitude depends on the country because of sometimes very different structures of the European systems. This shows that market risk is not only a factor as important as the lack of equity in the banking fragility, but also may in some cases undermine the scope of regulatory measures put in place.

In the specific case of Cameroon, a major program of consolidation of the banking system into bankruptcy is introduced in the second half of the 1980s. The first work to focus on analysis and evaluation of banking reforms in this context was back in the early 1990s. In this sense, the work group ESF (1991) and Tiani Kéou (1992) lean more on analysis of the causes of crises and bank failures and the reform measures put in place. Tchamanbé Djiné and Tamba, 1995 show in their study on the evaluation of these measures through the analysis of prudential ratios, that recent results have been undeniable. Overall, banks have regained their liquidity. However, we note that the proportion of bad loans remains important in the balance sheets of banks and only a few meet the standard relating to prudential solvency ratio. A component of a subsequent study (Tchamanbé Djiné, 2001) confirms previous results i.e., the excess liquidity bank paradoxically coexisting with a low rate of involvement of banks in financing the economy. In other words, the study reveals the existence of paradox excess liquidity and credit rationing.

The same trend is confirmed in a number of recent studies. Addressing the problem in a sub-regional view, Wanda, 2007 states indicators of liquidity CEMAC⁴ are positive since 1994, as already noted with regard to Cameroon. In an analysis of developments in the banking system post bank restructuring, Avon and Eyeffa Ekomo, 2007 examine the attempts of internationalization and financial innovations including product few banks in the banking system in Cameroon. The results show a trend still very shy, integration of Cameroonian banks in the comity of the international economy in the era of globalization of services based on the knowledge economy and innovation. In the same vein, Hugon, 2007 stressed that the results of the restructuring and banking reforms and institutional reveal a healthy banking sector in the CEMAC zone. This good health is linked to improving the financial situation characterized by excess liquidity and strong profitability of banks⁵ because of their focus on less risky activities in some sectors such as petroleum, agro-industrial populations and to creditworthy and bankable.

In total, from this perspective, it appears that the banking sector in the CEMAC zone in general and Cameroon in particular, is now completely cleaned up and stable. Can we all say that the banking

For the analysis of crises and bank failures in sub-Saharan Africa, see Fofack, H. 2006), "nonperforming Laons in Sub-Saharan Africa. Word Bank Working Paper WP3769, and Daumont R. F. The Call and F. Leroux (2004), Banking in Sub-Saharan Africa: What Went Wrong? IMF Working Paper WP // 04/55

³ This applies to the Banking Commission of Central Africa (COBAC) in CEMAC (Economic and Monetary Community of Central Africa) of which Cameroon is a member.

⁴ Central Africa Monetary and Economic Community

⁵ Refer to Table 1 and Table 2 in Annex.

system in CEMAC, namely that of Cameroon would not run the risk of bank failure? In other words, the current financial health of banks in Cameroon means it no risk of bank failure in Cameroon? The banking systems will it not risk even in a situation of excess liquidity present?

These questions are based on the interest of our study whose objective is to assess the risk of bank failure in Cameroon. Indeed, in a situation of banking stability marked by excess liquidity and rationing paradox, wonder whether we can still speak of bank failure or try to measure this risk or finds its relevance. Because the risk of default is seen as a key element among all the risks affecting a financial asset, hence the need to quantify its effects, to estimate the risk of failing to grasp the best price that risk.

In this context, the methodological approach adopted in a context without the stock market, as one in which banks are operating in Cameroon, is a discriminant analysis or approach by the Z-scores. It is more complete that the approach mean-variance (Markowitz, 1952), indicated that the method by the distance to default (Merton, 1974) using essentially the stock market data that do not exist within the economy considered. In this perspective, after the presentation of different approaches to measuring bank failure as a first step (1), follow an analysis applied to the banking system in Cameroon in a second (2).

1. Approaches to Risk Assessment of Bank Failure

The purpose is to analyse on one hand, the approaches to risk assessment of bank failure, and the measures of bank failure on the other.

1.1. Analysis of Approaches to Assessing the Risk of Bank Failure

In its ordinary meaning, the risk can be defined as the possibility or the possibilities of occurrence of an event not reaching an objective or to achieve a desired result. For Crosbie and Bohn, 2003⁶, risk is defined as the uncertainty faced by the capacity, ability, or the ability of a firm to meet its debts and obligations. The uncertainty on this result is the fact that we can not predict with accuracy based of the non-knowledge of the future today. It identifies the state of an agent who is not sure what happens or should happen. In doing so, the uncertainty is undoubtedly due to the unpredictability in the occurrence of phenomena, random events, but also due to the lack of information and ignorance of reality.

This definition of Crosbie and Bohn highlights the relationship between risk and uncertainty that has been at the heart of a debate fuelled by Knight, 1921⁷, Keynes, 1936⁸ and Hayek, 1973-1979⁹. Knight, 1921 made the distinction between risk and uncertainty, the risk is the uncertainty of probabilities. Thus a situation is risky when the prediction can be based on probabilities. However, an uncertain situation is not considered probable. Although using different terminology, the uncertain and likely to Keynes, 1936, partial knowledge and rule among Hayek, it is recognized from these two authors; the distinction made by Knight between the uncertainty of probabilities and risk. In sum, since Knight, 1921, economists have become accustomed to distinguish the risk, which is characterized by a probability based on the objective realization of random events and the uncertainty of probabilities is not. The first is generally insurable and can be avoided or reduced through preventive measures, while the second makes prediction is impossible and that precaution does not guarantee complete in the result.

⁶ Crosbie P. and Bohn, J. 2003, "Modeling Default Risk", Moody's KMV Company, December 18

⁷ Knight H. (1921) [197 1a], Risk Uncertainty and Profit, Houghton Mifflin, Boston, and University of Chicago Press, Chicago

⁸ Keynes J. M. (1936), The General Theory of Employment, Interest and Money, Macmillan, London, in Collected Writings, vii.

⁹ Hayek J. (1973-1979), Law, Legislation and Liberty, Routledge, London, tr. fr. (1980-1983), Law, Legislation and Liberty, PUF, Paris.

Thus, the risk of failure may be the combination of a risk of probabilities, and not a risk of uncertainty of probabilities. In other words, the risk of bank failure can be explained both by the probability of occurrence of unpredictable events and uncertainties.

Financial theory offers several approaches to risk assessment of bank failure grouped for analytical purposes in traditional approaches and recent approaches. The traditional approach involves essentially the ratio method and the mean-variance approach.

The Ratio Method

Traditionally, the assessment of credit risk is achieved by analyzing various key financial ratios of banking¹⁰. This approach tries to identify with more or fewer ratios calculated from the balance sheet and income statement, over-threshold arbitrarily regarded as critical. Thus, under the solvency ratio which is the standard prudential and 5% in Cameroon, it seems that a bank is failing when it is below this standard. We can therefore say that the default risk is measured as the case here, by not meeting or exceeding the thresholds. As presented, the ratio method is the subject of many criticisms of the first comes from the theory of finance and is on the definition of risk.

Proponents of the approach - mean-variance (Markowitz, 1952) in particular, accused him of not resting on any theoretical basis. Also, does is not consider the effects of diversification of portfolio risk because it does not take into account the covariance of returns of various assets comprising the latter. In the same vein, Santomero, 1983 shows that the ratios approach by conducting an individual assessment of various risks to which it is difficult to derive an overall assessment of the risk portfolio of the bank, overall risk is not a simple sum of individual risks. In doing so, it does not take into account any compensation for these risks.¹¹

For Goyeau and Tarazi, 1992, the ratios approach does not lend itself to a comparison of the fragility of banking systems in different countries. For not only the accounting rules and habits differ, but the significance of different ratios can vary from one country to another. Moreover, they note that even in its advanced approach to multidimensional analysis, simultaneously the ratios versus the one-dimensional ratio by ratio, the shortcomings identified above remain valid. This may well be understood in that the risk of failure can be assessed more as already noted by the thresholds are exceeded, but by fluctuations of mean-variance.

The Mean-Variance Approach

In this approach, the risk is assessed by fluctuations or variance rate of return of the portfolio. Unlike the ratio method, the mean-variance approach has a theoretical basis because it takes into account the effects of diversification on portfolio risk. It is also taken into account the covariance of asset returns and offset risk. However, it also has limitations. Goyeau and Tarazi, 1992 note with regard to the mean-variance approach that, whatever the measure; the portfolio risk is a partial assessment of the risk of failure or fragility bank. Moreover, it does not take into consideration the ability of banks to cope with risks. For both writers, any appropriate measure of bank fragility must also take into account the ability of the bank to meet its commitments. For any additional risk does not necessarily translate into an increased risk of failure, since it is covered by a strengthening of the capital. Thus, the risk of failure must be understood by them as the result of two effects: an effect of level of risk and effect of the degree of coverage by own funds.

Recent approaches to assessing risk of bank failure using the default probabilities to estimate the risk of failure. These can be either based on the Z-Scoring approach or on the distance to default (Merton, 1974).

¹⁰ It may be the ratio, equity / debt, loans compromise knew total credit, net income on equity, net income on total assets, etc.;

¹¹ Santomero (1983) shows, for example, that greater risk taking interest rate reduces the credit risk borne by the bank.

The Z-Scoring Approach

The Z-score approach is a statistical analysis, using a combination of quantitative ratios, determined on the basis of samples of firms observed on a number of years, leads to a function that calculates a measure called "Z" Score.¹²

The magnitude and sign of the score or indicator obtained to measure within a given interval, the probability of a company to be defective. The discriminant functions Z are now widely used in the preventive diagnosis of failure. The more discriminant functions Z are important that is to say, have a high score, the bank earns more points and the probability of failure is low, and vice versa. In sum, the higher the Z score is negative, the risk of failure increases.

The Approach by the Distance to Default

In this approach, the risk of failure is measured by the distance to default and the default probability associated with it. Since the model (Merton, 1974), we know that to set the distance to default of a firm, three things are needed: the market value of the assets of the firm, the value of the volatility of the asset and Finally, the book value of debts of the company, or its liabilities. From these elements, the distance to default (DD) is given by the ratio of the difference between market value of assets and liabilities carrying value and the value of the volatility of the asset, and that is formally it follows: $DD = (\text{market value of assets} - \text{book value of assets}) / \text{volatility of the asset}$ ¹³. Thus, the volatility of a security that goes over the entire rating or bends more is high. It is zero for a value that is evolving as the medium is negative for an action under or climbs back less than the average rating.

As presented, the assessment of risk of default by the distance to default is a comprehensive measure that takes into account both the risks of banking activities - exhibition portfolio risk activity - and the coverage of these by risk capital. Furthermore, compared with traditional measures, it takes into account the effects of the portfolio of assets and debt risk - structures variance - covariance yields - . An asset to assess the risk of default is entered by its market value using the stock market statistics. However, in the framework applied to our analysis, market data are not available. Also, we are forced, despite the general trend of the international accounting reforms that seek to use market values in the balance sheets of companies, using accounting data to measure the bank failure.

1.2. Measuring Bank Failure

To measure the failure of the banking system in Cameroon, we used discriminant analysis or approach in terms of Z-scores more complete and more appropriate in our case. We rely on two main assumptions:

- The profitability of banks follows a normal distribution;
- There is a default or bank failure since its value (V) is negative, that is to say:

\tilde{A} = Value of assets.

D = Liabilities (deposits);

\tilde{c} = The cost of commitments;

\tilde{A} and \tilde{c} being random.

Three indicators for measuring bank failure are defined depending on whether one accepts the approach in terms of return on equity (1.2.1), profitability of assets (1.2.2) or the level of profit bank (1.2.3).

1.2.1. Approach in Terms of Return on Equity

Building on the work of Roy (1952), Heggstad (1978), Boyd and Graham (1986)), the probability of default is defined as the probability where losses exceed equity. Formally it is written:

¹² Trust and Financial Dictionary (1991), The Villeguérin Editions, Paris

¹³ The volatility of an asset is the propensity or tendency to do that asset price movements more than the increase or decrease the market average.

$$\text{Probability of default} = \text{prob}(\tilde{\Pi} < -E) \tag{1}$$

$\tilde{\Pi}$: Net profit of the bank;

E : Capital or equity of the bank;

$$\tilde{A} = E + D + (E + D) \tilde{i} = (E + D)(1 + \tilde{i})$$

\tilde{i} : The rate of future performance of the asset.

There was failure if :

$$\tilde{\Pi} = (E + D)(1 + \tilde{i}) - D(1 + \tilde{c}) < 0$$

$$\Rightarrow (\tilde{i} - \tilde{c})D + E\tilde{i} < -E$$

Replacing $\tilde{\Pi}$ by its value, the expression (1) becomes:

$$\text{Pr ob}\left(\frac{\tilde{\Pi}}{E} < -\frac{E}{E}\right) = \text{Pr ob}(\tilde{r}_e < -1) \tag{2}$$

Where: \tilde{r}_e is the random rate of return on capital (financial profitability). Assuming that $\tilde{\Pi}$ is normally distributed then:

$$\text{Pr ob}(\tilde{r}_e < -1) = \text{Pr ob}\left[\frac{\tilde{r}_e - \bar{r}_e}{\sigma_{\tilde{r}_e}} < \frac{-1 - \bar{r}_e}{\sigma_{\tilde{r}_e}}\right] = \text{Pr ob}\left[\frac{\tilde{r}_e - \bar{r}_e}{\sigma_{\tilde{r}_e}} < -Z\right] = \text{Pr ob}\left[\frac{\tilde{r}_e - \bar{r}_e}{\sigma_{\tilde{r}_e}} > Z\right] \tag{3}$$

Where \bar{r}_e and $\sigma_{\tilde{r}_e}$ are respectively the mean and standard deviation of the rate of return of capital.

\tilde{r}_e = Net profit / capital.

$$Z = \frac{1 + \tilde{r}_e}{\sigma_{\tilde{r}_e}} \tag{4}$$

By analogy, we can set a flag Z^* from the raw values. We have:

$$Z^* = \frac{1 + \tilde{r}'_e}{\sigma_{\tilde{r}'_e}} \tag{4'}$$

Where: \tilde{r}'_e = gross profit (RBE) / capital

Boyd and Graham, 1988 show however, that this indicator Z does not explicitly distinguish the effect of risk hedging effect. They point out that this distinction is possible if one takes either an approach in terms of net yield of assets, or an approach in terms of profit level.

1.2.2. The Approach in Terms of Return on Assets

By retaining the approach in terms of net yield of assets or economic efficiency, the probability of failure is written:

$$\text{Pr ob}\left[\frac{R\tilde{N}}{A} < -\frac{E}{A}\right] = \text{Pr ob}\left[\tilde{r}_a < -\frac{E}{A}\right] \tag{5}$$

Where \tilde{r}_a is the net rate of return of assets and A total assets of the bank. Equation (3) becomes:

$$\text{Pr ob}\left[\frac{\tilde{r}_a - \bar{r}_a}{\sigma_{\tilde{r}_a}} < \frac{-\lambda - \bar{r}_a}{\sigma_{\tilde{r}_a}}\right] = \text{Pr ob}\left[\frac{\tilde{r}_a - \bar{r}_a}{\sigma_{\tilde{r}_a}} < -Z'\right] = \text{Pr ob}\left[\frac{\tilde{r}_a - \bar{r}_a}{\sigma_{\tilde{r}_a}} > Z'\right] \tag{6}$$

\bar{r}_a and $\sigma_{\tilde{r}_a}$ represent respectively the mean and standard deviation of the rate of return on assets or business profitability;

$$r_a = \frac{RN}{A} ; \text{Where RN is the net result}$$

$$\lambda = \frac{E}{A} , \text{the ratio of equity and}$$

$$Z' = Z'_1 + Z'_2 \quad (7)$$

$$Z'_1 = \frac{\bar{r}_a}{\sigma_{\bar{r}_a}} ; Z'_2 = \frac{\lambda}{\sigma_{\bar{r}_a}}$$

r_a = Net Income / Total Assets

The decomposition of Z' allows distinguishing the risk portfolio Z'_1 , and the degree of coverage of this risk Z'_2 . The fragility is even greater than Z' is low. In other words, the risk of failure is even greater than \bar{r}_a is low and $\sigma_{\bar{r}_a}$ is high. Similarly we can define:

$$Z'^* = \frac{\bar{r}'_a + \lambda}{\sigma_{\bar{r}'_a}}$$

$$Z'^* = Z'^*_1 + Z'^*_2 \quad (7')$$

$$Z'^*_1 = \frac{\bar{r}'_a}{\sigma_{\bar{r}'_a}}$$

$$Z'^*_2 = \frac{\lambda}{\sigma_{\bar{r}'_a}}$$

r'_a = Gross operating income (RBE) / total assets.

1.2.3. The Approach in Terms of Profit Level

By retaining the approach in terms of profit level, the probability of failure is written:

$$\text{Pr ob}(\tilde{\Pi} < -E) = \text{Pr ob}\left[\frac{\tilde{\Pi} - \bar{\Pi}}{\sigma_{\tilde{\Pi}}} < \frac{-E - \bar{\Pi}}{\sigma_{\tilde{\Pi}}}\right] = \text{Pr ob}\left[\frac{\tilde{\Pi} - \bar{\Pi}}{\sigma_{\tilde{\Pi}}} > \frac{E + \bar{\Pi}}{\sigma_{\tilde{\Pi}}}\right] = \text{Pr ob}\left[\frac{\tilde{\Pi} - \bar{\Pi}}{\sigma_{\tilde{\Pi}}} > Z''\right] \quad (8)$$

$\bar{\Pi}$ and $\sigma_{\tilde{\Pi}}$ are respectively the mean and standard deviation of profit.

$$Z'' = Z''_1 + Z''_2 \quad (9)$$

$$Z''_1 = \frac{\bar{\Pi}}{\sigma_{\tilde{\Pi}}} \quad \text{et} \quad Z''_2 = \frac{E}{\sigma_{\tilde{\Pi}}} \quad (9)$$

We obtain a new decomposition of default risk in portfolio risk (Z''_1) and degree of coverage of this risk capital (Z''_2).

The bank will be more fragile than Z'' is low.

The model presented and called a number of critical observations.

The indicators Z , Z' and Z'' can classify banks according to their risk of failure. The measures Z' and Z'' can also identify the origin of the risk of failure that is to say, if it is mainly due to high exposure of the portfolio of the bank to various risks of business or else, if it comes rather from insufficient capital to absorb the losses as usual.

Moreover, these two measures are based as noted Furlong, 1988 on a strong assumption that the bank is declared bankrupt when its market net worth becomes negative. We agree with Kane, 1989 that this implies that the statement of bank failures resulting from the immediate consequences of market

forces. However, in banking, bankruptcy is often the result of a decision of the authorities related to market conditions. In this case, we saw Cameroonian banks kept alive artificially for several years despite their negative net position. It therefore appears that, although market values show the bankruptcy of banks, socially, these are not declared bankrupt. This means in other words that, the calculated probabilities are mathematical probabilities, not social because the calculations do not take into account social aspects. Given this, these indicators tend to overestimate the actual probability of bankruptcy and make more account of "probability of encountering serious problems" cash.

In total, from the theoretical analysis of different approaches to risk assessment of bank failure and its extent, the approach in terms of Z-scores is found to be most appropriate in the context of our study. It led to the identification of a number of indicators to measure failure following profitability, equity, assets and profit level. What do these indicators mean when they are estimated empirically?

2. Review of Empirical Indicators of Risk of Bank Failure

In exercising its financing activities, the Cameroon bank like any other bank is exposed to several kinds of risks. Failure to control them puts them at risk of failure. The objective is to assess the determinants or indicators to measure the default risk of the banking system in Cameroon using the Z scores approach. To do this, we first present the methodological approach used (2.1), then, follow the analysis and interpretation of results (2.2).

2.1. Methodological Approach

The empirical estimation requires prior specification of the assumptions, variables of the model and details on data used and the period of analysis.

2.1.1. Assumptions and Model Variables

It is assumed that:

- Bank profitability follows a normal distribution;
- The deposit money banks do not assess their risks properly;

To estimate the various indicators measuring the risk of bank failure in Cameroon, four variables are specified.

1. The net equity: equity used here are capital broadly defined by the regulations in this area. These net capitals of banks consisting of gross capital (core capital (Tier I) over similar resources (Tier II).
2. The net operating result (RNE): $RNE = RBE - \text{depreciation charges and provisions}$. The gross operating income ($RBE = \text{Net Bank (PNB)} + \text{ancillary products} - \text{overhead}$). It measures the ability of the banking system to secrete wealth through its activities beyond the normal expenses inherent in them.
3. The net profit or net income (RN): $RN = RNE + \text{profits} - \text{tax (in case of profits)}$, or $RN = RNE - \text{loss} - \text{taxes (for losses)}$. Neglecting the taxes in our case, we identify RN RNE.
4. Total assets (A) of the bank represent the total assets.

2.1.2. Data Model

The estimation of indicators of bank failure was made using the annual accounting data reconstructed from: Bulletin of Studies and Statistics of the BEAC, the annual activity reports of the Banking Commission of Central Africa (COBAC), the Franc Zone, the BEAC, the National Council of Credit and Money Market Bulletins of the BEAC. These are the main sources of data available and accessible used in almost all studies on the banking sector. It should be noted here that multiple sources of data and therefore different methodologies, increases estimation errors and the resulting dispersion may bias our results.

Furthermore, it has unfortunately not been possible, collect despite the sources consulted¹⁴, the individual data bank by bank to make our calculations as desired. Thus, having failed to provide individual data bank by bank and over a long period, we have chosen for our statistical calculations that aggregate data for all banks. However, an aggregate analysis implicitly accepts a number of assumptions somewhat unrealistic. It assumes that all banks in the system have the same size or even important. In other words, those small and large banks have the same level of fragility. This may underestimate the fragility of the banking system if banks appear more vulnerable than smaller ones, or over-estimate otherwise. An aggregate analysis also implies the absence of effects of contagion in the interbank system.

2.1.3. The Period of Analysis

Researches on the banking sector in Cameroon date back from mid-1970s. However, having failed to provide data for the whole period of analysis, our tests are conducted only from 1980. For all indicators of failure Z, Z', Z'', an estimate is made throughout the period 1980- 2006 and on the sub-periods, 1980-1988, 1989-1997, 1998-2006 to detect possible changes differentiated.

- Sub period 1980-1988: the results obtained here should be able to evaluate the behaviour of indicators of bank failure before the official declaration of the crisis and bank failures in Cameroon¹⁵ and before the entry into force of the vast restructuring program bank¹⁶.
- Sub period 1989 -1997: here is appreciated in full banking crisis, the impact of bank restructuring measures implemented behavioural indicators of bank failure.
- Sub period 1998-2006: The findings should help to assess indicators of bank failure and post-post crisis bank restructuring, where the banking system is experiencing stability marked by excess liquidity, high profitability of banks (Table 2) address deficiencies in the financing of economic development (Hugon, 2007).

2.2. Analysis and Interpretation of Results

The analysis and interpretations were made following the previous three approaches namely: the approach in terms of return on equity (2.2.1), profitability of assets (2.2.2) and the level of profit (2.2.3).

2.2.1. Indicators for Measuring Default Risk in Terms of Return on Equity

The indicators of bank failure and the probabilities associated¹⁷ with them obtained at different times and in periods of analysis may be found in Table 4 and Table 4a.

¹⁴ Several data sources were consulted: the annual activity reports available to some banks in Cameroon have not been able to establish a data set searched. The various numbers available from Global Development Finance and International Financial Statistics IMF, World Development Indicators and the Africa Development Indicators World Bank, provide at most country data. In the database Bankscope seen on the web, does not appear unless I am mistaken, even Cameroon.

¹⁵ The official announcement of the crisis in the banking system was published May 31, 1989 by government decisions relating to the solutions of the Cameroon Development Bank (BCD) of the Cameroon-bank (CB), Bank of Paris and the Netherlands (PARIBAS), division, liquidation of the Company of Cameroon Bank (SCB).

¹⁶ The plan of reorganization or consolidation bank is implemented in two phases: the first phase between 1988 and 1991 and the second phase began in December 1995 and marked by the liquidation of Credit Agricole du Cameroon (ACC) in September 1997, the split-liquidation in March 1997 of the International Bank for Trade and Industry in Cameroon (BICICI) became the Cameroon international bank for savings and credit (BICEC) and its privatization in January 2002.

¹⁷ The default probabilities are read from the table Average Centered reduced from the values of indicators Z

Table 4: Indicators in terms of return on equity

Period	\bar{r}_e	$\sigma_{\bar{r}_e}$	\bar{r}_e'	$\sigma_{\bar{r}_e'}$	Z	Z*
1980-1988	0,32849914	0,810784346	0,6840758	0,27956756	0,94934310	6,02385985
1989-1997	-0,23792238	0,950837823	0,39301337	0,318728005	0,80148012	4,3705396
1998-2006	0,43908895	0,051113564	1,12528228	0,091583593	28,1547371	23,2059281
1980-2006	0,17655524	0,780572229	0,73412382	0,391577665	0,93413285	4,42855651

Table 4a: Probability of failure associated with indicators of bank failure in terms of return on equity

Period	Z	Prob Z	Z*	Prob Z*
1980-1988	0,94934310	0,051	6,02385985	0,000
1989-1997	0,80148012	0,220	4,3705396	0,000
1998-2006	28,1547371	0,000	23,2059281	0,000
1980-2006	0,93413285	0,066	4,42855651	0,000

Results of Table 4 and Table 4a, emerged the following lessons:

- Over the period 1980-2006, the indicator of bank failure Z has substantially the same value as before the banking crisis (1980-1988) (Table 4a). We also note that the probability of failure associated with Z during these two periods is small, but nonzero. This means that despite the constantly mentioned indicators (rate of return is high, compliance with prudential standards) to explain the stability and financial soundness of the banking system today, the results nevertheless indicate a probability of default non-zero (6.6 %). This result covers a long period, may hide some revelations differing trends of the fragility of banking in different periods.
- Before the banking crisis that is to say between 1980-1988, the probability of bank failure on the order of 5.1%, increases gradually with the crisis and bank failures of years 1989-1997, to 22% then decrease dramatically to become zero after the banking crisis. There was the whole period, a compensation effect results from the failure of strong banks and those of low failure. This is reflected by the fact that the indicator of failure during the crisis ($Z = 0.80148012$) is slightly below the pre-crisis indicator ($Z = 0.9493431$) and well above after the crisis ($Z = 28.1547371$) (Table 4, Table 4a).

In sum, there has been a downward trend of the indicator Z between sub-periods 1980-1988 and 1989-1997. Its decline reflects a growing fragility in the banking time. This trend is confirmed by the liquidation of the Bank-Meridian BIAO in June 1996, the settlement division of the International Bank for Trade and Industry in Cameroon (BICIC) in March 1997, and the liquidation of Credit Agricole du Cameroon (CAC) in September 1997.

- Z values and associated probabilities are different from one period to another. This heterogeneity of results shows the existence of a period effect in relation to banks in Cameroon for those three periods, because banks are not the same for the three sub periods. Some bankruptcies were dissolved, others restructured are still active and new banks have entered the banking market.
- The implementation of the restructuring plan first generation bank in 1989 has not made significant changes to this area until 1997. The positive change that occurs between 1998 and 2006 is to be attributed to action of the second phase of banking restructuring initiated in December 1995. Apart from some withdrawals and liquidations of banking licenses, this phase has witnessed the entry of new banks, banking, and growth of banking and consolidation of the financial structure of banks. This largely cash

creditor¹⁸ of the banking system explains the current excess liquidity. Overall, the bank restructuring measures have had a positive effect, that of reducing considerably the risk of failure of banks after the crisis. The periods before and during the crisis, have nothing in common with the period after the crisis. The bank restructuring effect is felt on the level of the indicator Z which goes 0.94934310 with a probability of failure of 5.1% before the crisis at 28.1547371 with a zero probability of failure after the crisis from by 0.80148012 with 22% probability of failure (Table 4a). For this no longer means the same bank, unless the banks up to be transformed completely. So there was as already stated, the effect of market entry of banks stronger and more stable and credible and the loss of fragile banks and bankrupt.

Altogether, these results indicate an increasingly fragile banking in sub-periods 1980-1988 and 1989-1997 and a decrease in the risk of bank failure between 1998 - 2006. It is possible to know whether this fragility of the banking system in Cameroon is due to capital levels or insufficient then, a large exposure of banks to the risk of their activities. To do this, we analyzed the measurement indicators of failure in terms of return on assets and in terms of profit level.

2.2.2. Indicators for Measuring Failure in Terms of Return on Assets

The results recorded during the periods and sub periods considered are on Table 5, Table 5 continued and Table 5a.

Table 5: Indicators of bank failure in terms of return on assets

Period	\bar{r}_a	$\sigma_{\bar{r}_a}$	\bar{r}'_a	$\sigma_{\bar{r}'_a}$	λ
1980-1988	0,007972415	0,01900433	0,01662251	0,005243482	0,02441727
1989-1997	0,001455557	0,0226084	0,01584511	0,018923266	0,03619585
1998-2006	0,001997953	0,00459785	0,02091066	0,005709923	0,04813546
1980-2006	0,009310721	0,01964408	0,02886935	0,021419861	0,03594535

Table 5: Indicators of failure in terms of return on assets (Continued)

Period	$Z'_1 = \frac{\bar{r}_a}{\sigma_{\bar{r}_a}}$	$Z'_2 = \frac{\lambda}{\sigma_{\bar{r}_a}}$	$Z' = Z'_1 + Z'_2$	Z^*_1	Z^*_2	$Z^* = Z^*_1 + Z^*_2$
1980-1988	0,41950528	1,28482704	1,70433232	3,1701274	4,65668984	7,82681724
1989-1997	-, 06438122	1,60099076	1,53660954	0,83733509	1,91276956	2,75010465
1998-2006	0,43454082	10,4691249	10,9036657	3,66216121	8,43014155	12,0923028
1980-2006	0,47397088	1,82983162	2,3038025	1,34778444	1,678132	3,02591644

Table 5a: Probability of failure associated with indicators of bank failure in terms of return on assets

Period	Z'_1	Prob Z'_1	Z'_2	Prob Z'_2	$Z' = Z'_1 + Z'_2$	Prob Z'
1980-1988	0,41950528	0,34	1,28482704	0,000	1,70433232	0,000
1989-1997	-, 06438122	0,527	1,60099076	0,000	1,53660954	0,000
1998-2006	0,43454082	0,33	10,4691249	0,000	10,9036657	0,000
1980-2006	0,47397088	0,526	1,82983162	0,000	2,3038025	0,000

A number of lessons emerge from these results:

- The fragility of the banking system stems from two major events: exposure of the bank at risk of its activities (Z'1) on the one hand, and insufficient capital (Z'2) other hand. The decomposition of the risk of failure in risk exposure of banks 'portfolios to the risk

¹⁸ Broadly, the cash from a bank represents all available cash, debit balances of banks and securities investment or quasi-money can become available, which owns the bank to meet its disbursement.

of their activities ($Z'1$) and risk due to inadequate coverage of these risks through equity ($Z'2$) reveals that: whatever the period of analysis, the risk to the business of intermediating between banks with other credit activity was the major factor in the risk of bank failure in Cameroon during the periods and sub periods considered. In other words, the risk from banking activities generated the default risk of banks more than has been the lack of capital. The accumulation of significant doubtful accounts recorded in Cameroon (Tchamanbé Djiné, 2009)¹⁹ between 1989 and 1997, demonstrates this fact.

- Results also reflect the period effect in relation to banks. This is reflected in the variation of results from one period to another, whatever the malfunction indicator considered (Table 5). Furthermore, the results also show the compensation effect between the results of performing banks and those banks less efficient. Indeed, the indicator $Z'1$ during the banking crisis is slightly below the indicator before the crisis. In other words, the probability of failure lower before the crisis (34%), increasing to 52.7% during the crisis (Table 5a).
- The restructuring was to lessen the risk of bank failures linked to affect the risk of banking activities, but does not cancel it. It appears that during the crisis, more than half of banks or 52.7% are in bankruptcy. After the reform measures, they are more than 33%. The probability of failure of the order of 52.7% shows that, the risk of failure was lowered by the crisis, the crisis with increases and decreases dramatically after the crisis.
- Arguing over the effect of risk level ($Z'1$) and the effect of hedging risk ($Z'2$), the results of $Z'1$ show a high probability of bank failure: 34% before the crisis, 52.7% during the crisis and 33% after the crisis, with an average of 52.6% over the analysis period (Table 5a). In contrast, the values of the indicator $Z'2$ reveal the absence of default risk before, during and after the banking crisis. This unlikely result is, explained to some extent offset by the effect of the periods of high bank recapitalization and the insufficiency of capital. Can we, referring to the distinction of Knight (1921), Keynes (1936) and Hayek (1973-1979) $Z'2$ absorb the risk of inadequate coverage of losses from equity to risk not probable that is to say the uncertainty?

In total, reasoning only in relation to the indicator $Z'1$, one can conclude that despite the stability of the banking system today, the risk of bank failure is not zero because the probability of failure due to the risk activities of banks (33%) (Table 5a). What about indicators of failure for level of profit ?

2.2.3. Indicators for Measuring Failure in Terms of Profit Level

The approach in terms of profit level allows like that in terms of return on assets, to decompose the risk of failure in risk exposure of banks to the risk of their activities (Z''_1), and risk resulting from inadequate coverage of losses from equity (Z''_2).

The results obtained are shown in Table 6 and Table 6a.

Table 6: Indicators of failure in terms of profit level

Period	$\bar{\Pi}$	$\sigma_{\bar{\Pi}}$	Z''_1	Z''_2	$Z'' = Z''_1 + Z''_2$
1980-1988	7897,33333	19631,58807	0,40227685	10,88954186	11,2918187
1989-1997	-2803	19385,87165	0,14458984	13,68883508	13,5442452
1998-2006	18791,5556	3652,491573	5,14485939	107,1318009	112,27666
1980-2006	7961,96296	18327,76259	0,43442089	47,49335854	47,9277794

¹⁹ Tchamanbé Djiné L. (2001), Depression and bank failures in sub-Saharan Africa: the case of Cameroon, PhD, University of Montesquieu Bordeaux IV, France

Table 6a: Probability of failure associated with indicators of bank failure in terms of level of profit

Period	Z''_1	Prob Z''_1	Z''_2	Prob Z''_2	$Z'' = Z''_1 + Z''_2$	Prob Z''
1980-1988	0,40227685	0,344	10,88954186	0,000	11,2918187	0,000
1989-1997	-0,14458984	0,558	13,68883508	0,000	13,5442452	0,000
1998-2006	5,14485939	0,000	107,1318009	0,000	112,27666	0,000
1980-2006	0,43442089	0,332	47,49335854	0,000	47,9277794	0,000

Table 6a shows that:

- The indicator of failure Z'' -value is high on all periods and sub periods. If we confine ourselves only to the total values of Z'' and the probabilities of failure associated with zero, one can say that the risk of failure is neither before nor during or after the crisis. This paradoxical result is warranted by the phenomenon of compensation between the performances of banks, more efficient and less efficient ones. The high bank-recapitalization enormous capital resources and solvency of large banks, have boosted this result is to say the risk of failure
- The values of the indicator Z''_2 are much higher than those of Z''_1 , regardless of the periods and sub periods analyzed. Given that, plus the value of the indicator of failure is higher, plus the probability of failure is low or even zero (Table 6a), different values Z''_1 and Z''_2 show that the risk of bank failure is mainly due to the exposure of banks to the risk of their activities, including their credit activities. As this indicator (Z''_1) represents the risk effect taken by banks in Cameroon, it is the latter that seems relevant to assess the default risk of banks.
- The probability of failure associated with the indicator Z''_1 , (34.4%) before the crisis, increases sharply (55.8%) during the crisis and canceled after the crisis (Table 6a). This variation results from period to period shows as already noted, the structure of banks has changed: some are dissolved, others restructured, and new banks entered the banking market.
- Implementation of restructuring bank has lowered considerably the risk of bank failure, which moves from a situation where 55% of banks were in bankruptcy during the crisis to 0% after the crisis. However, the argument over the period 1980-2006, led to an average probability of bank failure nonzero, 33.2% (Table 6a).
- In summary, the following key lessons emerge from the analysis:
- Failures and bank failures are rooted in two important facts: the insufficient coverage of risk capital and banks' exposure to the risk of their activities. However, the respective levels of the indicators show that the effects of exposure to the banking outweigh the effects related to the lack of bank capital (Table 5 and Table 6).
- The bank restructuring measures have significantly reduced the risk of bank failure, while not completely cancel because of the uncertainty. This means that despite the situation of stability of the banking system today marked by excess liquidity and strong profitability, the risk of bank failure including the risk resulting from exposure of banks in their lending activities, is not zero.

Conclusion

Following this study on risk assessment of bank failure in Cameroon through its analysis and measurement, it appears that bank failures recorded between 1980 and 2006 result: a shortage of capital which can not cover the risks taken by banks, between 1980 – 1997, and a high exposure of banks to risk their financial intermediation activities.

The decomposition of the risk of failure in risk exposure of banks' portfolios to the risk of their activities and risk due to inadequate coverage of these risks by capital reveals that: whatever the period

of analysis used the risk of the activity of banks intermediation, namely credit activity, was the major factor in the risk of default and bank failures in Cameroon during the periods and sub periods. In other words, the risk from lending by banks has generated the risk of default and bankruptcy, more than has been the lack of capital. In other words, the exposure of bank portfolios to the risk of their activities has further contributed to their failure than has been the inadequate coverage by own funds.

The analysis also reveals consistency of results showing how, whatever the approach, the probability of failure, low before crisis, increases dramatically during the crisis and decreased after the crisis. Similarly, there is an effect of heterogeneity results which can be explained by changes in values of indicators of failure of one period to another and a compensation effect is observed also through their sometimes very high values.

The approach by the return on equity and the profit level shows that the risk of failure in times of stability now is zero. However, this risk exists if one refers to the approach by the profitability of assets where the probability of failure after the crisis is not zero. In other words, the risk of bank failure such as the risk due to exposure of banks to their activities is not zero, even during the current stability. This shows there that the risk of failure of the banking system in Cameroon is due to both the risk and uncertainty probable corroborating work Hugon and ali. (1995) under which, the arbitration takes place in those parts of Africa, between uncertainty and not between liquidity risk and liquidity?

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Appendix

Table 1: Evolution of liquidity ratios of banks in Cameroon (%)

	March 2000	July 2000	August 2000	September 2000	August 2002	Sept 2002	August 2004	Sept 2004	Octobe 2004	Nov 2004	Dec 2004
BICEC	135.2	136.24	121.3	107.17	238.73	239.53	239	236	260	236	203
CLC	112.38	122.04	138.54	210.97	189.22	197.08	221	210	222	165	191
SGBC	152.64	132.32	132.02	90.36	214.4	223.88	223	220	242	209	210
Standard Chartere Bank	164.94	152.77	155.7	196.82	205.07	164.61	192	186	171	237	207
Afriland	207.72	310	283.71	320.15	295.53	304.18	342	279	237	311	319
Amity	96.8	106.8	97.8	98.01	111.29	111.29	102	127	129	103	138
CBC	171.46	153.82	130.72	189.48	260.19	266.45	125	138	122	123	134
Citibank	128.49	226.67	206.83	177.87	183.21	221.57	55	190	98	112	100
UBC					119.95	119.95	123	146	165	99	58
Ecobank					127.76	83.03	183	81	152	139	168

Source: Table made from data taken from the Activity Reports of COBAC

Table 2: Changes in rates of return on equity and assets (%)

Period	$re = RN / (E)$	$r'e = RBE / (E)$	$ra = RN / (A)$	$r'a = RBE / (A)$
1980	0,07764288	0,41278372	0,00351752	0,018700691
1981	0,05688718	0,29817833	0,00245961	0,012892241
1982	0,03969008	0,36754149	0,00136075	0,012600933
1983	-0,01201893	1,01642313	-0,00030526	0,025815098
1984	2,62040175	1,0375713	0,06163733	0,024405847
1985	0,04906937	0,85270728	0,00100768	0,017511017
1986	0,07994807	0,98068913	0,00124408	0,015260583
1987	0,01124246	0,67649004	0,00021664	0,013035607
1988	0,03362944	0,5142978	0,00061339	0,00938055
1989	-0,03451074	0,73408341	-0,00052263	0,011116964
1990	-2,86060475	0,5494131	-0,05672612	0,010894924
1991	-0,12500435	0,12298422	-0,00440305	0,004331899
1992	-0,09335103	0,12340414	-0,00463934	0,006132911

Table 2: Changes in rates of return on equity and assets (%) - continued

1993	0,00277244	0,41198433	0,00010695	0,015892663
1994	-0,12801452	-0,12801452	-0,00521852	-0,005218524
1995	0,27692941	0,27692941	0,00818381	0,00818381
1996	0,47358486	0,47358486	0,02730897	0,027308974
1997	0,34689722	0,97275136	0,02280992	0,063962413
1998	0,52	0,96494012	0,03055896	0,056706854
1999	0,52935691	1,16724948	0,026557	0,058559055
2000	0,39507535	1,11148244	0,01581029	0,044479772
2001	0,40258987	1,22579933	0,01540648	0,046909406
2002	0,42169317	1,1442943	0,01819864	0,049383307
2003	0,46356275	1,1497767	0,02254436	0,055916866
2004	0,43606056	1,26166526	0,02114286	0,061173188
2005	0,40047088	1,11106206	0,02194951	0,06089647
2006	0,38299101	0,99127086	0,02056964	0,053239063

Source: Compiled from data, BEAC, newsletters Studies and Statistics, COBAC, activity reports, the National Credit Council, activity reports and Franc Zone, annual reports, various issues.

Table 3: Changes in equity, the gross operating profit and net profit of commercial banks (in millions of CFA francs).

End of period	Rough equities	Equities Nets (E)	Total Assessment (A)	Gross profit of Exploitation (RBE)	Profit or Bottom line (RN)
1980	26839	20839	459983	8602	1618
1981	42161	28161	651322	8397	1602
1982	49329	26329	767959	9677	1045
1983	62364	24295	956572	24694	- 292
1984	46337	24194	1028565	25103	63398
1985	64215	23640	1151161	20158	1160
1986	82432	18487	1188028	18130	1478
1987	101341	24194	1255561	16367	272
1988	11670	23640	1296086	12158	795
1989	119512	18487	1220747	13571	- 638
1990	105695	18487	932269	10157	- 52884
1991	141951	28711	815116	3531	- 3589
1992	77267	35404	712386	4369	- 3305
1993	75884	27052	701267	11145	75
1994	84385	34168	838168	- 4374	- 4374
1995	62249	24295	822111	6728	6728
1996	88200	42911	744151	20322	20322
1997	112581	35855	545289	34878	12438
1998	129240	33400	568344	32229	17368
1999	150841	30027	598524	35049	15895
2000	154454	31718	792585	35254	12531
2001	175756	36218	946420	44396	14581
2002	195078	46918	1087169	53688	19785
2003	206984	47918	985302	55095	22213
2004	219153	48413	998493	61081	21111
2005	238270	54366	991913	60404	21772
2006	263112	62320	1160351	61776	23868

Source: Compiled from data, BEAC, newsletters Studies and Statistics, COBAC, activity reports, the National Credit Council, activity reports and Franc Zone, annual reports, various issues.